We claim:

1. A pneumococcus type 5 capsular polysaccharide which is aminated on the terminal aldehyde group and which exhibits (i) a carbon (^{13}C) NMR spectrum lacking a resonance signal between 13 and 14 ppm inclusive; (ii) an HPAEC-PAD chromatogram obtained by elution from a Carbopac™ PA10 column in an 18 mM sodium hydroxide solution at a flow rate of 1 ml/min for 15 min of monosaccharides derived from hydrolysis of said polysaccharide, wherein said chromatogram lacks a peak between fucosamine and pneumosamine peaks; or (iii) both.

2. The polysaccharide according to Claim 1, which exhibits:

   (i) a carbon NMR spectrum which comprises a resonance signal between 11.5 and 12.5 ppm, inclusive, characteristic of a Sug compound, and a resonance signal located between 17 and 18 ppm inclusive, characteristic of N-acetylated quinovosamine, the intensity of which is less in comparison with the resonance signal located between 17 and 18 ppm, inclusive, in the (^{13}C) NMR spectrum of a pneumococcus type 5 capsular polysaccharide obtained after reductive amination in the presence of sodium cyanoborohydride at pH 8 for 48 hours; or

   (ii) an HPAEC-PAD chromatogram obtained under the conditions specified in Claim 1, which comprises a peak located immediately after the pneumosamine peak, characteristic of quinovosamine, the intensity of which is less in comparison with the equivalent peak in the HPAEC-PAD chromatogram of a pneumococcus type 5 capsular polysaccharide obtained after reductive amination in the presence of sodium cyanoborohydride at pH 8 for 48 hours; or

(iii) both.

3. The polysaccharide according to Claim 1 which exhibits (i) a carbon NMR spectrum entirely lacking a resonance signal between 17 and 18 ppm; (ii) an HPAEC-PAD chromatogram obtained according to the conditions of claim 1 lacking a quinovosamine peak, the peak observed with the polysaccharide aminated according to a conventional amination method being reduced so as to be no more than a simple shoulder of the preceding peak (pneumosamine peak) ; or (iii) both.

4. The aminated polysaccharide according to Claim 1, which exhibits:

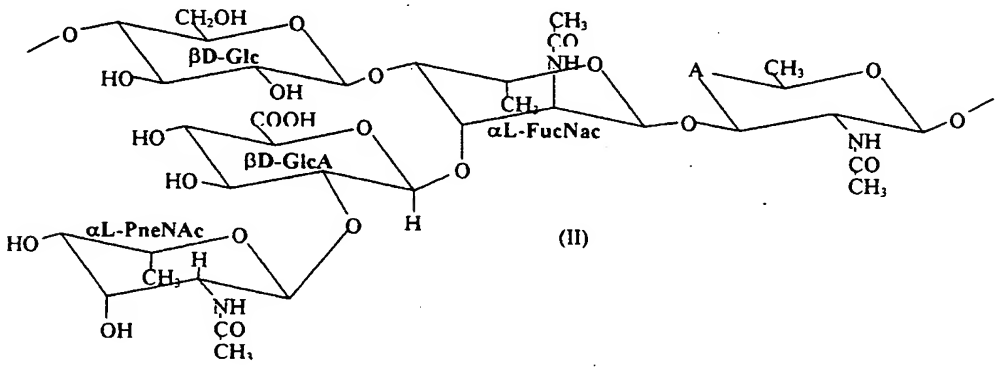
(i) a carbon NMR spectrum lacking a resonance signal between 11.5 and 12.5 ppm, inclusive, characteristic of a Sug compound, which comprises a resonance signal located between 17 and 18 ppm inclusive, characteristic of N-acetylated quinovosamine, the intensity of which is increased in comparison with the resonance signal located between 17 and 18 ppm, inclusive, in the (^{13}C) NMR spectrum of a pneumococcus type 5 capsular polysaccharide obtained after reductive amination in the presence of sodium cyanoborohydride at pH 8 for 48 hours; or

(ii) an HPAEC-PAD chromatogram obtained under the specified in Claim 1 which comprises a peak located immediately after the pneumosamine peak, characteristic of quinovosamine, the intensity of which is increased in comparison with the equivalent peak in the HPAEC-PAD chromatogram of a pneumococcus type 5 capsular polysaccharide obtained after reductive amination in the presence

of sodium cyanoborohydride at pH 8 for 48 hours ; or

(iii) both.

5. A pneumococcus type 5 capsular polysaccharide which is aminated on the terminal aldehyde group, consisting of repeating units, at least 85% of the repeating units of which correspond to formula (II)

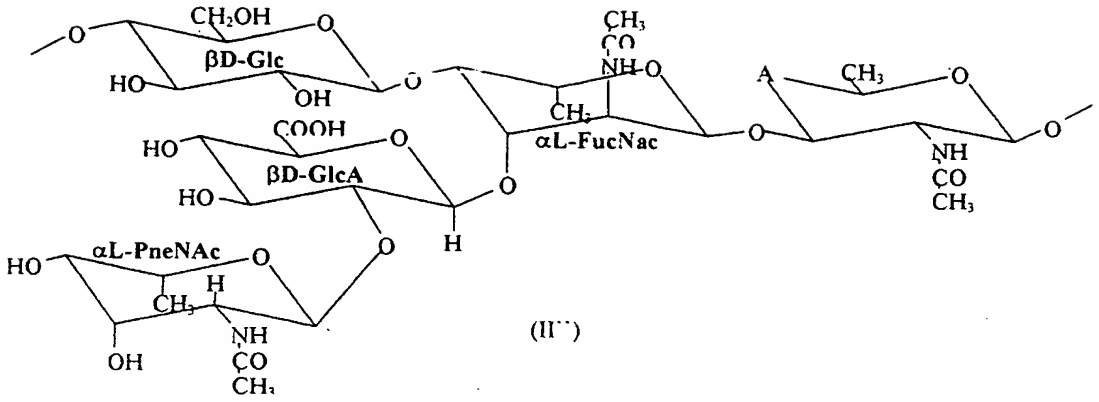


in which A is independently and randomly C=O or CHOH.

6. The polysaccharide according to Claim 5 in which at least 90% of the repeating units correspond to formula (II).

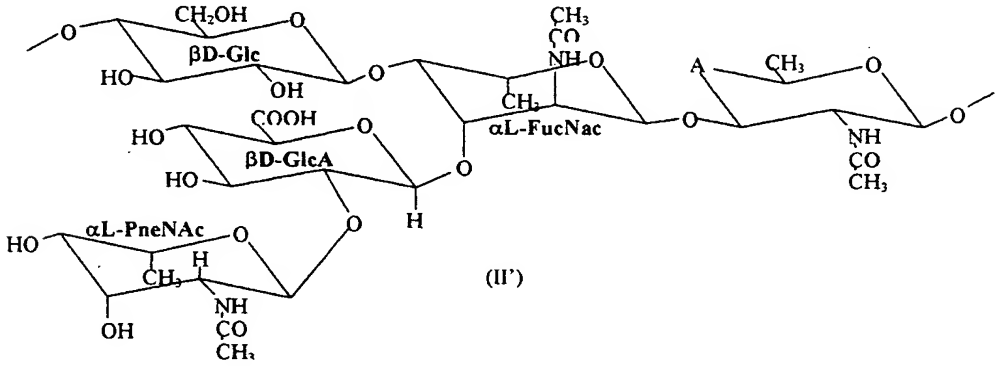
7. The polysaccharide according to Claim 6 in which at least 95% of the repeating units correspond to formula (II).

8. The polysaccharide according to Claim 5 in which at least 95% of the repeating units corresponding to formula (II) correspond to formula II"



in which A is CHOH.

9. The polysaccharide according to Claim 5 in which 85 to 95% of the repeating units corresponding to formula (II) correspond to formula II'



in which A is C=O.

10. The conjugate in which a polysaccharide according to Claim 1 is coupled to a carrier polypeptide (P).

11. A method for producing an aminated pneumococcus type 5 capsular polysaccharide, wherein the polysaccharide is subjected to a reductive amination in the presence of a reducing agent selective for a Schiff base at a pH of 4 to 6.5 for a period not exceeding 4 hours.

12. The method according to Claim 11 in which the polysaccharide is subjected to a reductive amination at a pH of 5 to 6.

13. The method according to Claim 11 in which the polysaccharide is subjected to a reductive amination for a period not exceeding 2 hours.

14. The method according to Claim 11 in which the reducing agent selective for a Schiff base is cyanoborohydride or pyridine borane complex.

15. A method for producing an aminated pneumococcus type 5 capsular polysaccharide, according to which (i) the polysaccharide is reacted with an agent for reducing a ketone function, (ii) the reduced polysaccharide is fragmented, and (iii) the reduced and fragmented polysaccharide is subjected to a reductive amination.

16. The method according to Claim 15 in which the polysaccharide which is reacted with the agent capable of reducing a ketone function is in native form.

17. The method according to Claim 15 in which the agent capable of reducing a ketone function is $NaBH_4$.

18. The method according to Claim 15 in which the reduced polysaccharide is fragmented by oxidative free-radical depolymerization.

19. A method for producing a conjugate of formula Ps-CH_2-NH-P, according to which a method according to Claim 11 is used, wherein the pneumococcus type 5 capsular polysaccharide (Ps) is coupled by reductive amination to a carrier polypeptide (P) in the presence of a reducing agent selective for a Schiff base at a pH of 4 to 6.5 for a period not exceeding 4 hours.

20. A method for producing a conjugate of formula Ps-*CH_2-NH*-P, according to which a method according to Claim 15 is used, in which the reduced and fragmented pneumococcus type 5 capsular polysaccharide (Ps) is coupled by reductive amination with a carrier polypeptide (P).

21. A method for producing a conjugate of formula Ps-*CH_2-NH*-L-P, according to which:
    (i) the method according to Claim 11 is used, wherein the pneumococcus type 5 capsular polysaccharide (Ps) is coupled by reductive amination to a linking agent (L) having at least one free amine function so as to form an aminated and activated polysaccharide of formula Ps-*CH_2-NH*-L, and the activated polysaccharide is coupled to a carrier polypeptide (P) in order to obtain the conjugate of formula Ps-*CH_2-NH*-L-P; or, alternatively,

    (ii) the method according to Claim 11 is used, wherein the pneumococcus type 5 capsular polysaccharide (Ps) is coupled by reductive amination to an activated carrier polypeptide of formula L-P, wherein L is a linking agent having at least one free amine function, in order to obtain the conjugate of formula Ps-*CH_2-NH*-L-P.

22. A method for producing a conjugate of formula Ps-*CH_2-NH*-L-P, in which:
    (i) (a) a method according to Claim 15 is used, wherein the reduced and fragmented pneumococcus type 5 capsular polysaccharide (Ps) is coupled by reductive amination to a linking agent (L) having at least one free amine function so as to form an aminated and activated polysaccharide of formula Ps-*CH_2-NH*-L, and (b) the activated polysaccharide is coupled to a carrier polypeptide (P) in order to obtain the conjugate of formula Ps-*CH_2-NH*-L-P; or, alternatively,

(ii) the method according to Claim 15 is used, wherein the reduced and fragmented pneumococcus type 5 capsular polysaccharide (Ps) is coupled by reductive amination to an activated carrier polypeptide of formula L-P, wherein L is a linking agent having at least one free amine function, in order to obtain the conjugate of formula Ps-CH_2-NH-L-P.

23. A method for producing a conjugate of formula Ps-CH_2-NH-S-L'-P, in which:

(i) the method according to Claim 11 is used, wherein the pneumococcus type 5 capsular polysaccharide (Ps) is coupled by reductive amination to a spacer (S) having at least one free amine function, so as to form an aminated and derivatized polysaccharide of formula Ps-CH_2-NH-S, and

(ii) (a) the derivatized polysaccharide is coupled with a linking agent (L'), in order to obtain an activated polysaccharide of formula Ps-CH_2-NH-S-L', then the activated polysaccharide is coupled with a carrier polypeptide (P), in order to obtain the conjugate of formula Ps-CH_2-NH-S-L'-P; or, alternatively,

(b) the derivatized polysaccharide is coupled with an activated carrier polypeptide of formula L'-P, in which L' is a linking agent, in order to obtain the conjugate of formula Ps-CH_2-NH-S-L'-P.

24. A method for producing a conjugate of formula Ps-CH_2-NH-S-L'-P, in which:

(i) the method according to Claim 15 is used, wherein the reduced and fragmented pneumococcus type 5 capsular polysaccharide (Ps) is coupled by reductive amination to a spacer (S) having at least one free amine function so as to form an aminated and derivatized polysaccharide of formula Ps-CH_2-NH-S, and

(ii) (a) the derivatized polysaccharide is coupled with a linking agent (L') in order to obtain an activated polysaccharide of formula Ps-CH_2-NH-S-L', then the activated polysaccharide is coupled with a carrier polypeptide (P), in order to obtain the conjugate of formula Ps-CH_2-NH-S-L'-P; or, alternatively,
(b) the derivatized polysaccharide is coupled with an activated carrier polypeptide of formula L'-P, wherein L' is a linking agent, in order to obtain the conjugate of formula Ps-CH_2-NH-S-L'-P.

25. The method according to Claim 19 , wherein the carrier polypeptide P is diphtheria toxoid or tetanus toxoid.

26. The method according to Claim 21 , wherein the linking agent (L) is a compound of formula (XII) R1-A-R2, in which:
A denotes an aliphatic or aromatic chain or a mixed aliphatic and aromatic chain, which may be substituted or unsubstituted;
R1 denotes a primary amine or a chemical radical carrying a primary amine; and
R2 denotes a functional group capable of reacting with a carbonyl, thiol or amine group.

27. The method according to Claim 26, wherein the linking agent (L) is an alkyl dihydrazide or a diaminoalkyl.

28. The method according to Claim 23 , wherein the spacer S is an aminothiol and the linking agent L' is a succinimidylmaleimidylalkyl.

29. The method according to Claim 23 , wherein the spacer S is a diaminoalkyl or a dihydrazide, and the linking agent L' is chosen from disuccinimidylalkyl or succinimidylmaleimidoalkyl compounds of formula (XIV) R3-B-R4 in which B is an alkyl group, R3 is a succinimidyl group and R4 is a succinimidyl or maleimido group.

30. A pharmaceutical composition comprising a conjugate according to Claim 10.

31. A pharmaceutical composition comprising a conjugate obtained using the method according to Claim 19.